Before the

Federal Communications Commission

Washington, D.C. 20554

In the Matter of	)	
Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding and Arrangements	)	IB Docket No. 99-67
Petition of the National Telecommunications and Information Administration to Amend Part 25 of the Commission's Rules to Establish Emission Limits for Mobile and Portable Earth Stations Operating in the 1610-1660.5 MHz Band	)	RM No. 9165

To: The Commission

COMMENTS OF INMARSAT LTD.

Kelly Cameron
Robert L. Galbreath
POWELL GOLDSTEIN
FRAZER & MURPY LLP
1001 Pennsylvania Ave., N.W.
Sixth Floor
Washington, D.C. 20004
(202) 347-0066

Its Attorneys

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Summary

Inmarsat supports the Commission's intentions to implement the GMPCS-MoU. As a general matter, Inmarsat believes that the Commission should seek to adopt rules that will, to the maximum extent possible, promote the development of GMPCS, especially as the Commission's actions are likely to influence the actions of other regulatory bodies concerned with the industry.

Inmarsat supports every effort of the Commission to implement regulations which will cause the least disruption to operating GMPCS systems and promote free circulation of GMPCS equipment, including exemption of terminals permanently installed on ships, boats or aircraft, as well as the grandfathering of terminals already operating in conjunction with licensed GMPCS systems. In addition, Inmarsat believes the Commission should take the most liberal position possible with respect to terminals brought into the United States for transit only and not for use. Inmarsat also encourages the Commission in its efforts to streamline the processes of licensing and certifying GMPCS terminals.

With respect to Inmarsat's own equipment, Inmarsat submits that the vast majority of its terminals are and will continue to be in compliance with the Commission's interference protection criteria. To the extent that any current Inmarsat terminals will not meet these standards, Inmarsat believes that the risk of interference from such non-compliant terminals is non-existent. Thus, Inmarsat urges the Commission to allow the continued operation of such terminals in the United States.

Finally, with respect to issues such as interference protection to GLONASS, enhanced 9-1-1 and position location capabilities, Inmarsat believes that no reason exists for imposition of additional regulation on GMPCS equipment at this time.

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Inmarsat Ltd. ("Inmarsat"), by counsel and pursuant to Section 1.415 of the Commission's Rules, hereby submits its comments in the above-captioned proceeding.[1] Inmarsat welcomes the opportunity to provide comments on this NPRM and supports the Commission's intentions to implement the Global Mobile Personal Communications by Satellite Memorandum of Understanding ("GMPCS-MoU") signed by the United States and other parties in February, 1997. Inmarsat's views regarding specific proposals contained in the NPRM are set forth herein.

I. Overview

As a general matter, Inmarsat believes that the Commission should seek to adopt rules that will, to the maximum extent possible, promote the development of GMPCS. The FCC and the U.S. Administration have been very instrumental in obtaining spectrum for GMPCS services at ITU World Radiocommunication Conferences and in negotiating the GMPCS MoU. It is therefore important that the

[1] Notice of Proposed Rulemaking, 1B Docket No. 99-67, RM No. 9165, FCC 99-37 (released March 5, 1999)("NPRM").

FCC implement the MoU in a manner that will help to promote the development of this industry.

The Commission has, for the most part, proposed to do exactly that. Inmarsat believes, however, that some of the Commission's proposals would be unduly restrictive and might, in fact, hinder the development of the industry. The Commission's actions will certainly be watched and probably emulated by other regulators. If the FCC does not adopt rules that ensure the free movement of GMPCS terminals, other regulators almost certainly will not – running the substantial risk that the development of this global industry will be stifled.

II. Certification of GMPCS Terminals

The Commission proposes to distinguish hand-held or portable GMPCS terminals from other mobile terminals.[2] Specifically, the Commission proposes to exempt mobile terminals permanently installed on ships, boats or planes from a requirement to obtain an FCC certification in conformance with the requirements proposed in this NPRM. Inmarsat supports this proposal as well as that on the "grandfathering" of terminals already operating in conjunction with licensed GMPCS systems. These proposals would be in full accord with the recognition in the GMPCS Arrangements that some GMPCS systems, such as Inmarsat, came into operation before the Arrangements were formulated. Also, Inmarsat agrees with the FCC's appreciation of the difficulty of recalling and retrofitting mobile earth stations already in commercial use.[3] Inmarsat itself is one example of a system with a large number of terminals (in excess of 150,000) already in commercial use.

The FCC proposes to rely on the ITU database to obtain information regarding certification processes of countries or regions certifying equipment not certified by the Commission itself.[4] By this method, the Commission proposes to develop a list of foreign-certified terminals approved for domestic use in the United States.[5]

Inmarsat believes that the ITU database could be used to solve at least part of the problem of "grandfathering" identified in paragraph 24 of the NPRM. This ITU database will list the satellite terminal types notified by satellite operators and

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[2] NPRM at ¶24.
[3] Id.
[4] NPRM at ¶26.

manufacturers to the ITU to be identified as GMPCS terminals. As manufacturers continue to produce those terminal types, they can apply the GMPCS ITU Registry mark. However, some terminals of those types may already be in the market before the notification process is completed. Thus, even though those terminals may not bear the ITU mark, nevertheless, they should be accepted by the FCC as GMPCS terminals, and allowed to enter the United States, either for use or transit only. With identifying data, such as manufacturer and model number, supplied by the FCC, it should be possible for customs officials to identify these terminals even without the ITU mark.

Inmarsat advocates the grandfathering of other satellite terminals that have not been notified to the ITU. Many types of Inmarsat terminals have received type approval from the FCC and/or other administrations. Such terminals can be recognized according to their marking. Inmarsat has a list of the brands of Inmarsat terminal types that can be supplied to the FCC and/or U.S. customs officials. Inmarsat can correspond with manufacturers of its terminals and request them to make known which type approvals they have received and, if they are interested in the U.S. market, to supply the FCC or U.S. customs officials with details. Based on its analysis of the data supplied, the FCC can decide whether the terminals can be brought into the United States.

The Commission also proposes that all terminals carried into the United States as a personal effect for transit be required to bear the ITU mark and, therefore, that unmarked terminals be prohibited from entering the United States.[6] Inmarsat is disturbed by the Commission's proposal and encourages the FCC to reconsider it for the following reasons. First, Inmarsat has not yet notified the ITU of its implementation of the GMPCS Arrangements, nor has it been licensed to provide domestic service in the United States. Inmarsat expects to notify the ITU in the very near future. However, until then, the Commission's proposals would seem to mean that terminals purchased in Europe, for example, could not be taken into the United States unless they bore either the ITU or FCC mark, even if they were only taken in as a personal effect, in transit and not used. Inmarsat opposes such a restriction. Instead, Inmarsat believes such terminals should be permitted to be brought into the United States with the proviso that they not be used, as is permitted in Europe.

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[5] Id.
[6] NPRM at ¶27.

The FCC further proposes to dismiss as premature all applications for certification of equipment affiliated with non-US-licensed satellites unless they are operating in accord with the FCC rules governing foreign providers of satellite service.[7] In view of the fact that Inmarsat became a UK-based company on April 15, 1999, the rules first adopted in the *DISCO II* Order[8] that apply to other satellite operators and satellite service providers as per section 25.137 of the Commission's Rules,[9] particularly subsection (c), will also now apply to Inmarsat and its service providers who wish to provide service in the United States. The reasons set out in *DISCO II* for prohibiting or restricting domestic use of Inmarsat – that it enjoyed certain privileges and immunities, etc. – are no longer valid.

The FCC also requests comment on the best way to streamline even further the licensing and certification process.[10] Inmarsat encourages the FCC to proceed in a way similar to that in Europe where the European Parliament and Council have adopted a Radio and Telecommunications Terminal Equipment (RTTE) Directive which places the burden on manufacturers to ensure compliance of their equipment with European standards, rather than on national regulatory authorities to certify or type approve the equipment. As a result of the RTTE Directive and various CEPT ERC decisions on free circulation and exemption from individual licensing requirements, satellite terminals can be used or carried without use from one country to the next in Europe.

Inmarsat also supports the FCC proposal that it not require any specific traffic data filings to the Commission from GMPCS operators or service providers.[11] Inmarsat encourages the FCC to encourage other countries to adopt the same approach of not requiring traffic data. Such a requirement would impose a significant regulatory burden on operators for little if any public benefit.

Inmarsat also supports efforts to reduce customs duties and to facilitate the circulation of GMPCS terminals.[12] We are concerned, however, that the Commission's proposal to develop a list of approved GMPCS terminals[13] could have

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[7] NPRM at ¶30.
[8] Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Services in the United States, Report & Order, IB Docket No. 96-111, 12 FCC Rcd 24094 (1997)("*DISCO II*").
[9] 47 CFR §25.
[10] NPRM at ¶31.
[11] NPRM at ¶36.
[12] NPRM at ¶41.
[13] NPRM at ¶41.

the effect of narrowing the U.S. commitment under the Information Technology Agreement (ITA) if it omits products that should be exempted from customs duties. Inmarsat opposes the adoption of any rule that might have this effect.

Inmarsat accepts that terminals should *operate* in compliance with FCC rules, as stated in paragraph 42 of the NPRM, but does not believe the FCC should have or adopt rules which would prohibit users from carrying equipment into the United States on a temporary basis if it is not going to be used. If the equipment is not used, then it cannot interfere with other users or systems or services. Thus, Inmarsat encourages the FCC to adopt a more liberal attitude in this regard. It is worth noting again that other regulators around the globe are likely to emulate the FCC's actions in implementing the GMPCS MoU. Unfortunately, this is particularly likely if the FCC adopts rules that tend to hinder the free movement of terminals.

III. Technical Requirements for GMPCS Terminals

Inmarsat notes that the FCC proposes to adopt rules essentially in accordance with the NTIA's recommendations. To summarize, the FCC proposal is to require the following:

(i) For Inmarsat terminals brought into service before January 1, 2002:

-70 dBW/MHz in 1559-1580.42 MHz,

-80 dBW/700 Hz in 1559-1585.42 MHz.

But after January 1, 2005, these terminals should meet the requirement in (ii) below.

(ii) For Inmarsat terminals brought into service after January 1, 2002:

-70 dBW/MHz in 1559-1605 MHz,

-80 dBW/700 Hz in 1559-1605 MHz.

Inmarsat recognizes that these proposed unwanted emission limits have been studied extensively over the last several years and does not wish to re-open those discussions. All the same, it is worth recalling that no final agreement was reached. The MSS community continues to believe that less severe limits would adequately protect GNSS. Inmarsat therefore accepts the proposed limits, though with the associated comments and proposals as given below.

A. Inmarsat Terminal Compliance

Although Inmarsat terminals have been in operation since well before the development of the GNSS protection criteria, they all have a high degree of compliance with those criteria resulting from Inmarsat system requirements and specifications as follows:

a) Inmarsat MESs are designed to receive in the band 1525-1559 MHz and operate in full duplex mode, i.e., simultaneous and continuous transmission and reception. This requires high suppression of unwanted transmissions in the receive band to avoid self-interference for telephony and data, which would cause the MES to fail the G/T requirements, and not function for the user. The GPS frequencies in the region 1559-1585.2 MHz automatically have a high level of protection due to proximity to the 1525-1559 MHz receive band. Another reason for the high level of protection in the band 1525-1559 MHz is the ship installation requirements in which more than one Inmarsat MES may need to be located close to one another on the same vessel. This forces stringent carrier-off limits in the Inmarsat receive band, and this is also reflected in low unwanted emissions in the GPS band.

b) During the period of the NTIA proposals, Inmarsat circulated the details of the possible new limits to the manufacturers. Inmarsat also issued a Change Proposal to the mini-M specification in March, 1998, which specified a limit of -70 dBW EIRP from 1559-1605 MHz for carrier-on and carrier-off in recognition of the requirements of the RNSS community. This was adopted as a formal Change Notice in September, 1998, and became part of the specification. All mini-M MESs type approved by Inmarsat after that date were tested to these limits, and even before that, the manufacturers had taken account of the protection criteria being flagged.

In order to confirm the above, Inmarsat terminal manufacturers have conducted tests to establish the levels of unwanted emissions in the 1559-1605 MHz band for several terminal types. These tests have all been made on a number of Inmarsat MESs which were all manufactured and type approved *before* the

notification of the more stringent GNSS limits in the Inmarsat specifications. In the following table, each row is for a different model, with two manufacturers of Inmarsat-C and three manufacturers of Inmarsat-B represented. The results are as follows:

Compliance for different Terminals, one row for each model.		
Inmarsat Standard	**Carrier-on -80dBW discrete (3kHz)**	**Carrier-on -70dBW/MHz**
Inmarsat-B	YES	YES
Inmarsat-B	YES	YES
Inmarsat-B	YES	NO, See Note 1
Inmarsat-C	YES	YES
Inmarsat-C	YES	YES
Inmarsat-C	YES	YES
Inmarsat-Phone (mini-M)	YES	YES

Note 1. The limit was only exceeded above 1604.5 MHz and only by about 3dB

Inmarsat-A would be expected to be similar to Inmarsat-B since the latter uses the same antenna/r.f. and above-decks system, with the main change being to the modulation (analogue to digital) and this only has an impact close to the transmit band.

For the above reasons, it is expected that all Inmarsat GMPCS MES terminals should meet the pre-2002 limits proposed by the FCC. The issue becomes how to deal with any Inmarsat MESs which are only compliant to the pre-2002 requirements, in the period after the year 2005.

B. Treatment of Already Existing Terminals Operating in GMPCS Systems

As stated above, Inmarsat supports the proposal in paragraph 24 of the NPRM and urges the FCC to grandfather already existing terminals operating in GMPCS systems, even if they do not fully comply with the proposed limits. The difficulty of recalling or retrofitting such terminals would be insurmountable. It also should be remembered that terminals already operating in the field will in due course be replaced as users upgrade to new models.

As further justification for grandfathering such terminals, Inmarsat would like to demonstrate that the continued usage of these terminals is not likely to prove detrimental to GNSS services. Inmarsat requests the FCC to look more closely at the interference mechanisms. As described in RTCA/DO-235 (Appendix F), these unwanted emission limits were derived from the consideration of an interference scenario where a mobile earth station with an omni-directional antenna is at 100 feet distance from a landing aircraft.

This scenario led to the derivation of a limit of MES EIRP of -70 dBW/MHz in the overhead direction that would result in the permissible level of interference (-146.1 dBW/MHz) at the GNSS receiver in the aircraft. However, MESs with directional antennas, such as most Inmarsat terminals, have to point at a geostationary satellite and will therefore have significantly reduced emissions in the overhead direction. Only in the case of an MES operating at the equator to a GSO satellite directly overhead would the interference level be equivalent to that from an MES with an omni-directional antenna. Thus, MESs with directional antennas can normally exceed these limits and still not cause interference in excess of the permissible levels given in RTCA/DO-235.

In fact, the analysis attached at Annex 1 shows that for typical directional MES types (Inmarsat-A, -B and -M), if they meet the -70/-80 dBW limits, significant margins (up to 24 dB) would exist with respect to the RTCA/DO-235 criteria. In other words, MESs can exceed the -70/-80 dBW limits by amounts less than or equal to 24 dB without causing unacceptable interference. Further, Annex 1 shows that in cases where a non-compliant MES exceeds the interference limits of RTCA/DO-235, the interference is caused only by terminals operating within a very small area in the direct vicinity of an airport. These areas are very small even for cases where the interference caused exceeds the RTCA criteria by as much as 10 dB.

It should be noted that the plots given in Annex 1 relate to an aircraft altitude of 100 ft in the landing path. It could be argued that for other altitudes also there might exist similar areas corresponding to a given excess. However it has also been shown in Annex 1 that, as expected for higher altitudes, these areas show a rapid decline, so much so that at 200 feet the innermost zone corresponding to 5 dB excess disappears altogether. This would demonstrate that the exclusion areas for 100 ft altitude could generally be relied upon.

For the above reasons, Inmarsat believes that the risk of interference from non-compliant terminals is non-existent and that continued operation in the United States of all already existing GMPCS terminals should be allowed.

C. Inmarsat-A Terminals

The Commission states that it does not propose any special treatment for land and maritime Inmarsat-A terminals.[14] However, this statement seems to be contradictory to the Commission's proposal in paragraph 24 not to extend its requirement for certification as discussed in subsequent paragraphs to those mobile terminals permanently installed on ships, boats or planes. Inmarsat therefore urges FCC to re-affirm that maritime Inmarsat-A terminals would be exempted from the proposed requirements.

As indicated above, Inmarsat-A terminals generally meet the -70/-80 dBW limits, and only in some cases are these limits exceeded by a few dB closer to 1605 MHz. Inmarsat feels that it would be unreasonable to refuse US market entry to maritime terminals for this marginal non-compliance in some cases.

To alleviate the concerns about possible interference to GNSS from maritime terminals, it should be noted that the analysis given in Annex 1 is applicable also to such terminals. Inmarsat is of the opinion that this analysis clearly demonstrates that the interference risk from such terminals is completely negligible.

Additionally, it should be remembered that Inmarsat-A terminals form an important component of the Global Maritime Distress and Safety System (GMDSS) of the International Maritime Organization (IMO) and fulfills the crucial safety of life service obligations for mariners on the high seas. Inmarsat, therefore, requests the FCC to adopt only such provisions that would minimize disruption to ship operations and maritime communications.

If particular existing land-based terminals (Inmarsat-A or other types) do not comply with the proposed limits, Inmarsat proposes that these should also be grandfathered for the reasons discussed above for GMPCS terminals. The FCC has already approved use of Inmarsat-A terminals in the United States in particular situations. Often, the usage has been in a semi-fixed situation or limited to a specified

[14] NPRM at ¶84-89.

geographical area. In such cases, the FCC has full control of the situation and the detailed restrictions that apply to these terminals should allow the FCC to permit continued use, even of non-compliant terminals, without any risk of interference to GPS or GLONASS. In view of the fact that some Inmarsat terminals have been approved for use in the United States in the past in order to assist in disaster relief or other emergencies, this would seem to be wholly appropriate in the public interest.

IV. Other Comments

The FCC seeks comment on whether to apply the interim limits, proposed to be applied only to "Big LEO" terminals operating in 1610 - 1626.5 MHz, to terminals transmitting in the 1626.5 - 1660.5 MHz range.[15] Inmarsat believes that there should be no reason to do so, since the FCC has determined that GLONASS does not need to be protected in the United States until after 2005. Any terminals already in operation in the 1626.5 - 1660.5 MHz band that do not meet the interim limits of -64/-74 dBW should therefore be allowed to benefit from the additional time period.

Inmarsat supports a postponement of the compliance deadline for the limits in the GLONASS band (1597-1605 MHz) in the event that progress toward domestic implementation of GLONASS proves slower than expected. If there are terminals in operation in 2005 that do not meet the -70/-80 dBW limits, we do not see any reason for the FCC not to allow these to continue to operate in such a scenario.[16]

Inmarsat does not believe it should be necessary to adopt limits in the band 1605 - 1610 MHz similar to those in Recommendation ITU-R M.1343. The limits in Rec. M.1343 are quite relaxed as they ramp up to -10 dBW/MHz at 1610 MHz.[17] Therefore it can reasonably be assumed that terminals will perform at least as well as that since the requirement of -70 dBW/MHz at 1605 MHz has to be met.

The FCC requests comment on whether GMPCS terminals should be required to have position location capabilities (enhanced 9-1-1).[18] Inmarsat believes that this should not be a mandatory requirement. Some existing systems do not have such capabilities but do nevertheless provide valuable services to the U.S. market.

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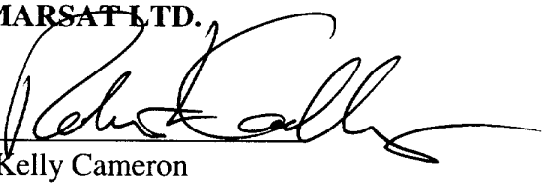
[15] NPRM at ¶70.
[16] NPRM at ¶73.
[17] NPRM at ¶83.
[18] NPRM at ¶98.

Inmarsat would like to suggest that appropriate notice should also be taken of the work being done in ITU-R/WP-8D on this subject. However, it is hoped that the FCC would be careful enough not to impose any unjustified, unsubstantiated requirements on the GMPCS terminals in addition to those being discussed in this NPRM. Spurious emission specifications of user terminals should be decided upon by the limits of available technology and not dictated only by considerations of protection of the adjacent band services.

Inmarsat believes the FCC should also follow the GMPCS Arrangements in regard to its consideration whether to require GMPCS terminals authorized for use in the United States to have position location capabilities. The Arrangements note that "[e]xisting and planned GMPCS Systems will vary technically in the level of information captured by the System"[19] but also state that "all future designed GMPCS systems should be structured to provide appropriate traffic data."[20] Although the existing Inmarsat satellite system does not have a position location capability, Inmarsat has developed plans for its next generation satellite system with such a capability. Thus, Inmarsat encourages the FCC to accept the limitations of existing systems with the assurance that future systems are planned to provide position-location capabilities.

Respectfully submitted,

INMARSAT LTD.

By: 

Kelly Cameron
Robert L. Galbreath
POWELL GOLDSTEIN
FRAZER & MURPY LLP
1001 Pennsylvania Ave., N.W.
Sixth Floor
Washington, D.C. 20004
(202) 347-0066

Its Attorneys

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[19] GMPCS Arrangements, Section V ("General Provisions"), item 10. See www.itu.int/gmpcs/gmpcs-mou.

[20] Id., Section VI.C.2.

Annex 1

Impact of Unwanted Emission Levels of Inmarsat MES Terminals in the band 1559-1605 MHz on GNSS Receivers

1. Inputs to the analysis

1.1 Inmarsat-3 satellite orbital locations

The Inmarsat orbital locations of 15.5° W, 54° W , 98° W and 178° E are considered in the analysis.

1.2 Inmarsat MES terminals gain patterns :

Antenna patterns for Inmarsat A, B and M(L) terminals are given in Table 1.

1.3 Typical Locations within US mainland

The following representative locations have been considered which include major US airports.

- Washington DC
- Long Island, New York
- Houston
- Miami
- Chicago
- San Diego
- Long Beach, California
- San Francisco
- Seattle
- West Palm Beach
- Honolulu
- Corpus Christi } These airport locations are closest to the satellite longitude 98 °W
- Harlingen } and are southernmost - so result in worst case geometry of interference.

The latitudes and longitudes of these locations are given in Table 2.

1.4 Interference Geometry

The geometry of the interference situation with Cat-I precision approach with 100 feet separation distance between the aircraft and MES terminal is described in RTCA/DO-235. This describes a scenario where the MES is directly below the aircraft, the separation distance is 100 feet, and the elevation angle of the MES terminal towards the GNSS receiver is 90°. In the following analysis, the extended scenario is also considered where the MES terminal is at a distance greater than zero feet from the sub-aircraft point, the elevation angle is less than 90° , and the distance to the aircraft is greater than 100 feet.

1.5 Interference Criterion

The unwanted emission limit of -70 dBW/MHz is derived in [1] (Table F-1) as follows.

Receiver Susceptibility Mask	-140.5 dBW/MHz
GNSS Antenna Gain towards RFI	-10 dBi
Interference Margin	5.6 dB
Path Loss (100 foot Min Sep Dist)	66.1 dB
MES Emission Mask (EIRP)	**-70 dBW**

Based on this derivation an interference criterion of **-146.1 dBW** at the GNSS receiver input is assumed, i.e. -140.5 dBW - 5.6 dB.

2. Interference Methodology

The interference calculations are done by adopting the methodology given below.

(a) For the given location of Inmarsat satellite and MES, the azimuth and elevation angles of the MES towards the satellite are computed.

(b) For the same MES location, the azimuth, elevation and off-axis angles of the MES towards the GNSS receiver are computed. For the calculated off-axis angle, the gain of the MES terminal towards the GNSS receiver is calculated.

(c) The power level I of the unwanted emission at the GNSS receiver is calculated from the following equation.

$$I = EIRP - G_{peak} + G(\theta) - L_i + G_{GNSS}$$

where

EIRP - Unwanted emission level of MES terminal

G_{peak} : Peak gain of MES terminal

$G(\theta)$: off-axis gain of MES terminal towards GNSS receiver (This is a function of MES location, Inmarsat satellite location, azimuth and elevation angles of MES terminal towards the GNSS receiver)

Li : free space path loss (function of the propagation distance between the MES and the GNSS receiver. This is computed from the elevation angle of MES terminal towards the GNSS receiver and the height of 100 feet assumed in Cat-I precision approach scenario)

G_{GNSS} : GNSS receiver antenna gain in the direction of interference. A gain of -10 dBi is assumed between -90° and -45° elevation angles (towards the Glonass satellite) and a linear interpolation between -10 dBi at -45° elevation and -4.5 dBi at 5° elevation is assumed in the calculations.

(d) The calculations are repeated for all locations within a 250,000 ft^2 square (500 ft side) centred on the sub-aircraft point (at 10 ft intervals). The highest interference level is identified.

(e) Finally, the size of the area from which an MES would cause interference in excess of the RTCA criteria if the MES produced an unwanted EIRP greater than -70/-80 dBW is calculated.

3. Results of Interference Analysis

The results of the interference analysis are given in Table 3. For the Harlingen, Texas, location which shows the worst results these are also shown in Figures 1(a), 1(b), 2(a) and 2(b). Figures 1(a) and 1(b) give interference plots at altitudes of 100 and 200 feet from Inm A/B MES terminal and Figures 2(a) and 2(b) give the corresponding interference plots for interference from Inm M(L) MES terminal. The following observations can be made.

• As expected, the interference levels at the GNSS receiver are below the criterion value of -146.1 dBW at all locations.

• The maximum interference levels at the GNSS receiver for various Inmarsat MES types are as follows:

Inmarsat-A and B :	**-146.85 dBW (0.75 dB margin)**
Inmarsat-M(L) :	**-146.37 dBW (0.27 dB margin)**

The margins available over and above the requirement of acceptable interference level for all the locations are given in Table 3. From Table 3, the following observations can be made.

• The margins vary from **0.75 dB** to **24.1 dB** over and above the criterion requirement for Inmarsat A and B terminals.

• The margins vary from **0.27 dB** to **15.1 dB** over and above the criterion requirement for Inmarsat M(L) terminals.

• The margin is directly related to the elevation angle towards the MSS satellite, i.e. the higher the elevation angle, the lower the margin. Thus the lowest margin is therefore found for the southernmost location, i.e. Harlingen(Texas).

• The sizes of the interference areas are given in Table 3 for unwanted EIRP levels of -65 dBW and -60 dBW. These interference areas are generally very small. The largest area found for a -65 dBW EIRP was 14,600 ft^2 and for a -60 dBW EIRP 53,800 ft^2.

Table 1: Inmarsat terminal antenna patterns

Inmarsat - A and B

Peak gain	21 dBi	
Radiation pattern	Gain pattern	Off-axis angle
	21.0	Main beam
	18.0	$10° < \theta < 16°$
	8.0	$16° < \theta < 21°$
	41-25 log (θ)	$21° < \theta < 57°$
	-3.0	$\theta > 57°$

Inmarsat-M(L)

Peak gain	12 dBi	
Radiation pattern	Gain pattern	Off-axis angle
	12.0	Main beam
	9.0	$20° < \theta < 25°$
	44-25 log (θ)	$25° < \theta < 76°$
	-3.0	$\theta > 76°$

Table 2: Location Particulars

Location	Latitude(N)	Longitude (W)
Washington DC	38 55	077 00
Long Island, New York	40 35	073 40
Houston	29 45	095 25
Miami	25 45	080 15
Chicago	41 50	087 45
San Diego	32 45	117 10
Long Beach, California	33 47	118 15
San Francisco	37 45	122 27
Seattle	47 35	122 20
West Palm Beach	26 42	080 05
Honolulu	21 19	157 50
Corpus Christi	27 47	097 26
Harlingen	26 12	097 43

Table 3: Maximum Interference Levels and Interference Areas

Location	Sat Long	Max Int Level	Margin	Interference Area in square feet		
		dBW/MHz		EIRP -70 dBW/MHz	EIRP -65 dBW/MHz	EIRP -60 dBW/MHz
Washington DC						
Inm A/B	54.0 W	-148.88	2.78	0	4300	12700
	15.5 W	-152.43	6.33	0	0	8500
	98.0 W	-148.61	2.51	0	4100	11800
Inm-M(L)	54.0 W	-147.70	1.60	0	14200	47300
	15.5 W	-150.73	4.63	0	2400	32800
	98.0 W	-147.48	1.38	0	14200	46400
Long Island, New York						
Inm A/B	54.0 W	-148.76	2.66	0	4200	13200
	15.5 W	-157.71	5.61	0	0	11300
	98.0 W	-149.21	3.11	0	4800	15300
Inm-M(L)	54.0 W	-147.67	1.57	0	14100	47000
	15.5 W	-150.04	3.94	0	3600	35900
	98.0 W	-147.97	1.87	0	13700	49500
Houston						
Inm A/B *	15.5 W	-157.72	11.62	0	0	0
	54.0 W	-149.34	3.24	0	4500	18700
	98.0 W	-147.17	1.07	0	2800	5000
Inm M(L)	15.5 W	-154.92	8.82	0	0	10000
	54.0 W	-148.19	2.09	0	12400	48500
	98.0 W	-146.58	0.48	0	10300	31800
Miami						
Inm A/B	54.0 W	-147.70	1.60	0	3200	7000
	15.5 W	-153.71	7.61	0	0	8800
	98.0 W	-147.17	1.07	0	2900	5000
Inm M(L)	54.0 W	-146.92	0.82	0	13700	39400
	15.5 W	-150.22	4.12	0	2700	31300
	98.0 W	-146.62	0.52	0	10600	32700
Chicago						
Inm A/B	54.0 W	-149.57	3.47	0	4000	19400
*	15.5 W	-155.21	9.11	0	0	700
	98.0 W	-148.46	2.36	0	4200	11400
Inm M(L)	54.0 W	-148.56	2.46	0	11700	53800
	15.5 W	-153.86	7.76	0	0	18400
	98.0 W	-147.57	1.47	0	14500	44500
San Diego						
Inm A/B	178.0 E	-154.04	7.94	0	0	7100
	54.0 W	-153.82	7.72	0	0	8500
	98.0 W	-148.02	1.92	0	3500	7500
Inm M(L)	178.0 E	-150.48	4.38	0	1700	29700
	54.0 W	-150.26	4.16	0	2600	31500
	98.0 W	-147.00	0.90	0	14300	41000

* *These values are computed over an area of 1000, 000 square feet.*

Long Beach, CA						
Inm A/B	178.0 E	-153.99	7.89	0	0	8000
	54.0 W	-153.99	7.89	0	0	7600
	98.0 W	-148.02	1.92	0	3500	8300
Inm M(L)	178.0 E	-150.31	4.21	0	2100	30900
	54.0 W	-150.38	4.28	0	1900	30100
	98.0 W	-147.17	1.07	0	14600	43300
Honolulu						
Inm A/B	178.0 E	-147.31	1.31	0	3000	5300
	54.0 W	-170.20	24.1	0	0	0
	98.0 W	-150.94	4.84	0	300	13200
Inm M(L)	178.0 E	-146.74	0.64	0	11000	33600
	54.0 W	-161.20	15.1	0	0	0
	98.0 W	-149.59	3.49	0	5800	36900
San Francisco						
Inm A/B	178.0 E	-151.71	5.61	0	0	10400
*	54.0 W	-153.76	7.66	0	0	4000
	98.0 W	-148.61	2.51	0	4300	12400
Inm M(L)	178.0 E	-150.09	3.99	0	3300	34800
	54.0 W	-151.04	4.94	0	100	24000
	98.0 W	-147.70	1.60	0	14200	47200
Seattle						
Inm A/B	178.0 E	-154.28	8.18	0	0	7200
*	54.0 W	-154.60	8.5	0	0	1900
	98.0 W	-149.60	3.50	0	4000	19300
Inm M(L)	178.0 E	-150.55	4.45	0	1400	31900
	54.0 W	-151.56	5.46	0	0	21200
	98.0 W	-148.61	2.51	0	10800	49900
West Palm Beach						
Inm A/B	15.5 W	-153.76	7.66	0	0	8600
	54.0 W	-147.97	1.87	0	0	7200
	98.0 W	-147.41	1.31	0	2900	5500
Inm M(L)	15.5 W	-150.22	4.12	0	2700	31200
	54.0 W	-146.92	0.82	0	14200	39500
	98.0 W	-146.74	0.64	0	11100	34000
Corpus Christi , Texas						
Inm A/B	98.0 W	-147.17	1.07	0	2800	4700
Inm M(L)	98.0 W	-146.58	0.48	0	9700	30000
Harlingen, Texas						
Inm A/B	98.0 W	**-146.85**	**0.75**	0	3000	4400
Inm M(L)	98.0 W	**-146.37**	**0.27**	0	9200	28800

* *These values are computed over an area of 1000, 000 square feet.*

Fig.1(a): Plot of Interference Levels at the GNSS Receiver at 100 feet altitude from Inm A/B terminal at Harlingen (26 N 12 Lat; 97 W 43 Long) in 625,000 square feet area (Sat Long: 98 W 00)

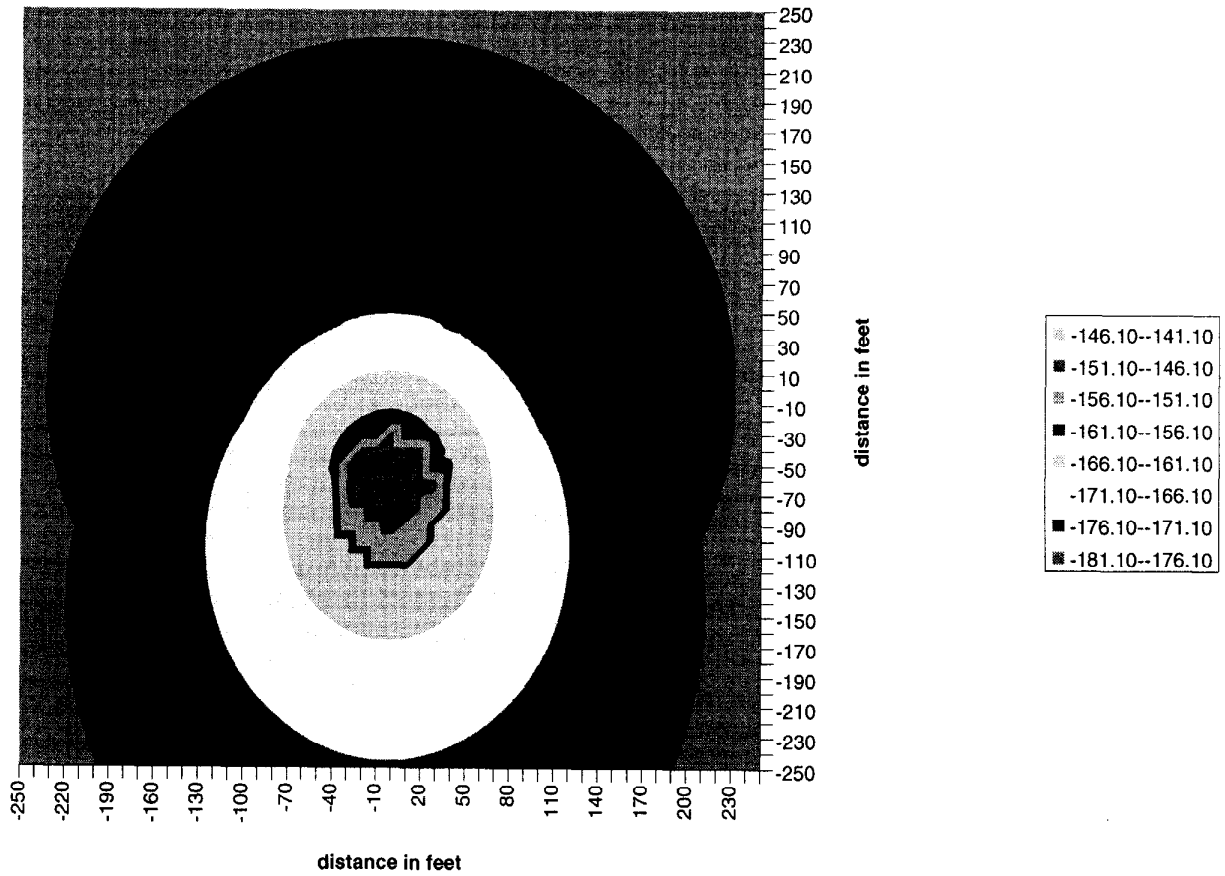


Fig. 1(b) : Plot of Interference Levels at the GNSS Receiver at 200 feet altitude from Inm A/B terminal at Harlingen (26 N 12 Lat; 97 W 43 Long) in 625,000 square feet area (Sat Long: 98 W 00)

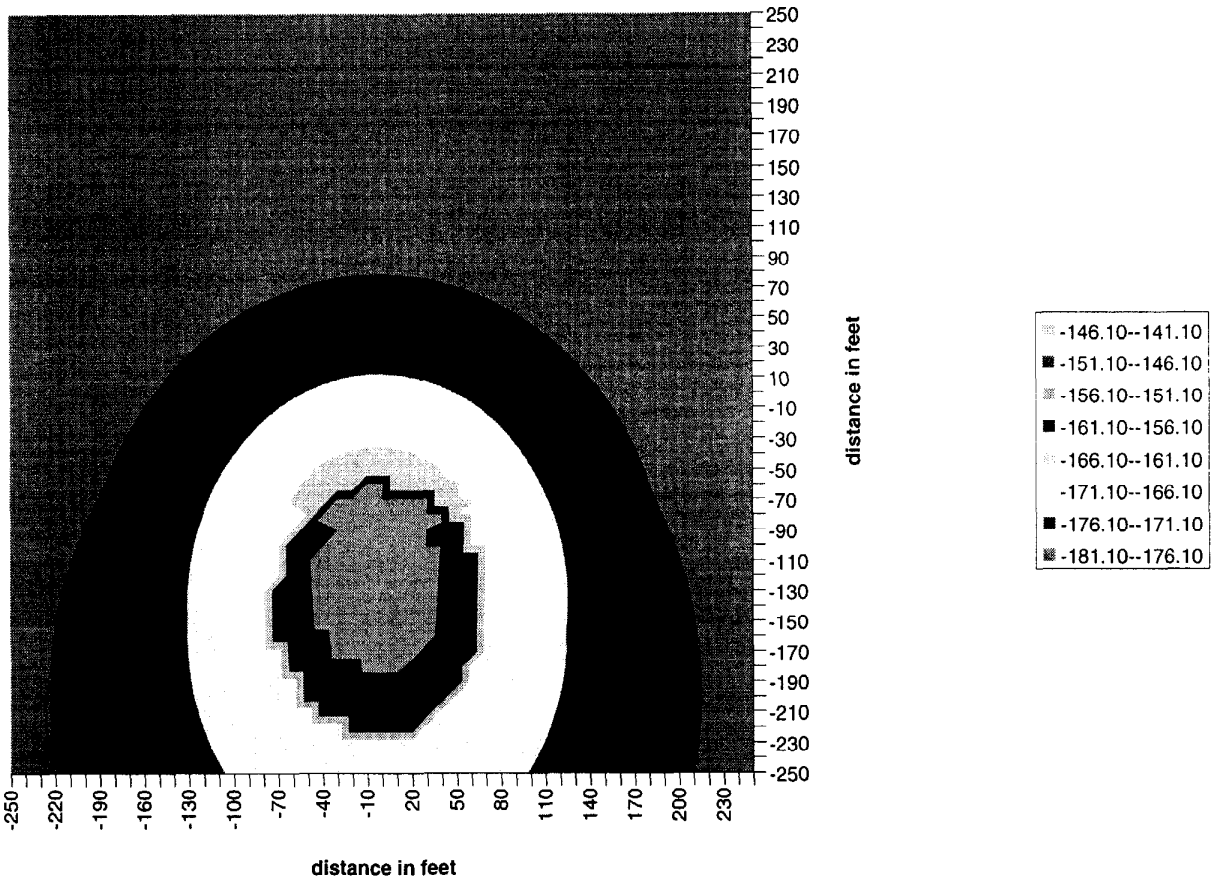


Fig. 2(a): Plot of Interference Levels at the GNSS Receiver at 100 feet altitude from Inm M(L) terminal at Harlingen (26 N 12 Lat; 97 W 43 Long) in 625,000 square feet area (Sat Long: 98 W 00)

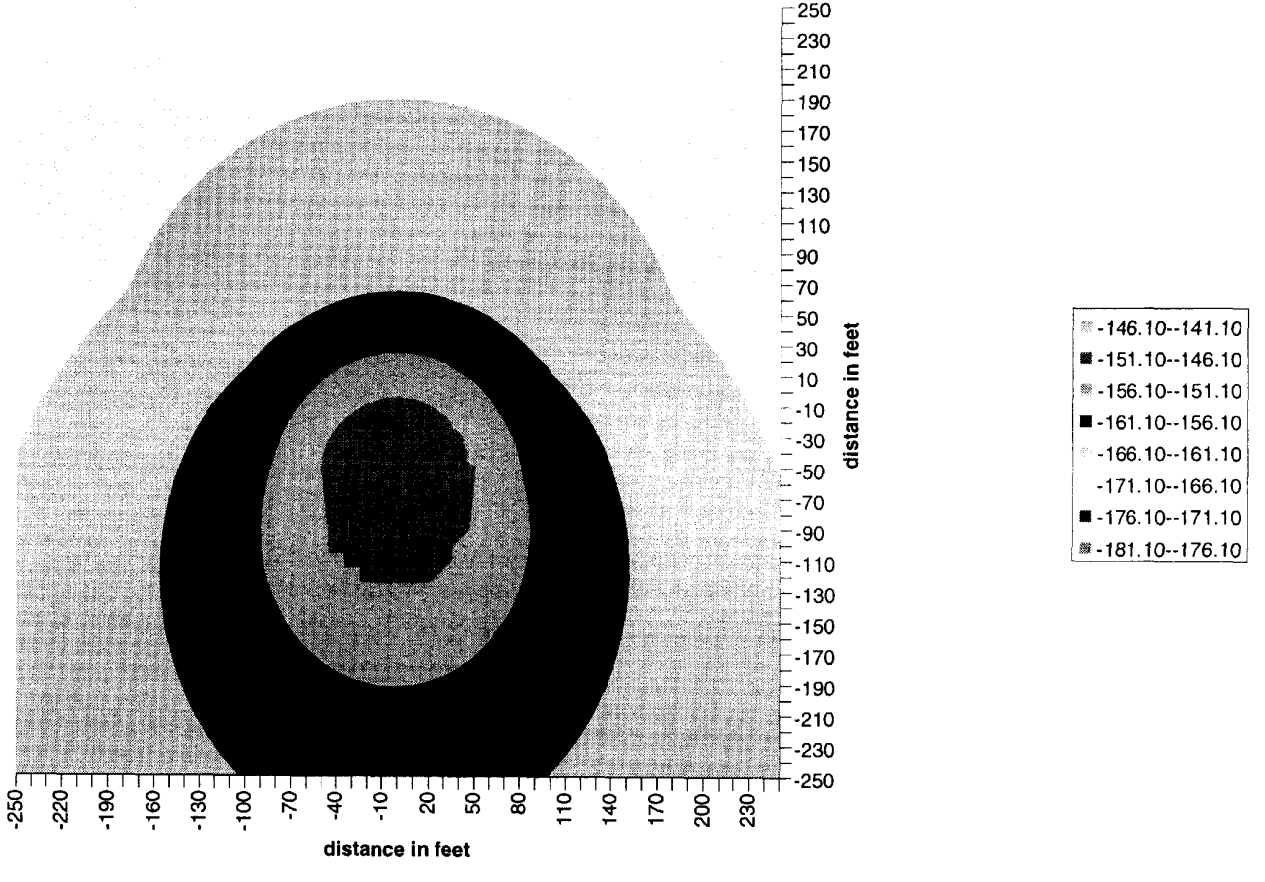
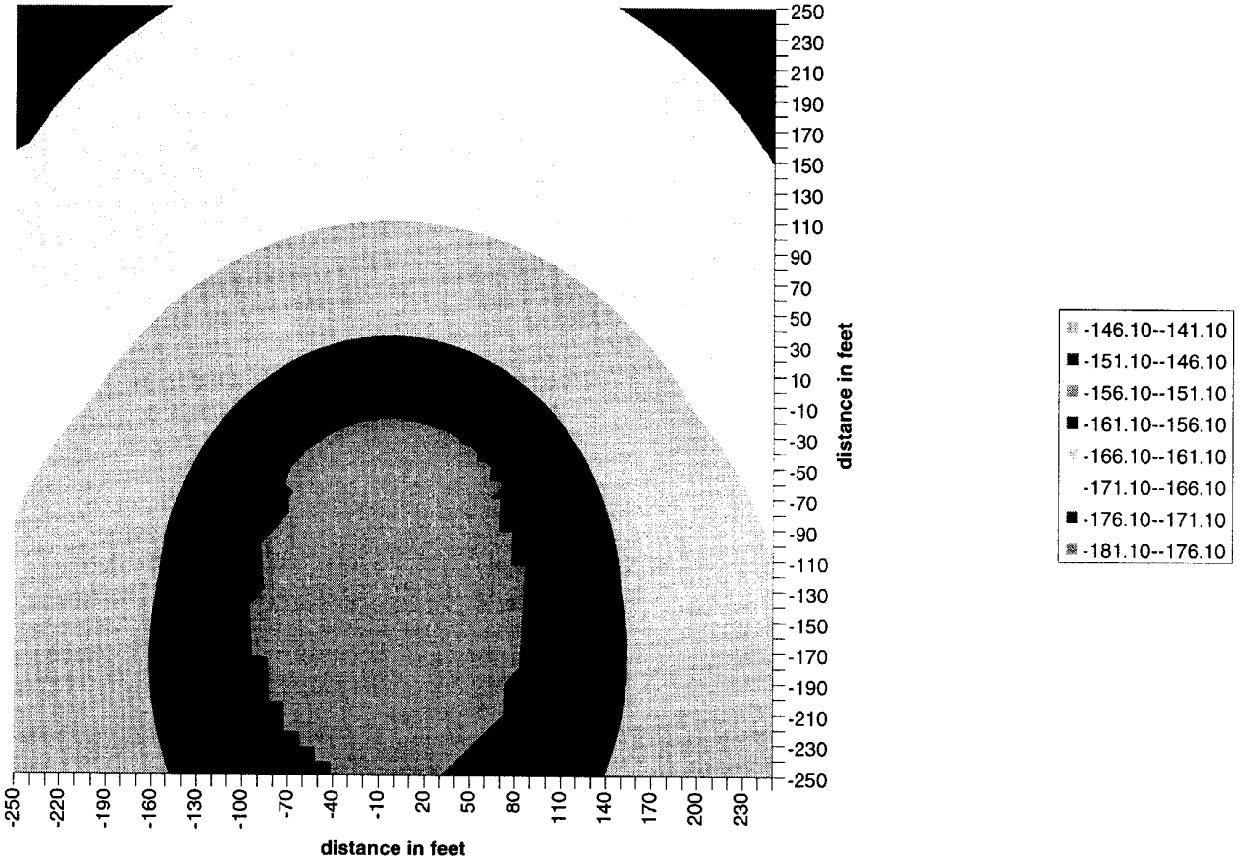


Fig. 2(b): Plot of Interference Levels at the GNSS Receiver at 200 feet altitude from Inm M(L) terminal at Harlingen (26 N 12 Lat; 97 W 43 Long) in 625,000 square feet area (Sat Long: 98 W 00)



Technical Certification

I, Ram Manoharan, hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in these Comments and attachments hereto, that I am familiar with Part 25 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in these Comments and attachments hereto, and that it is complete and accurate to the best of my knowledge.

By: R Manoharan .

Date: 21.6.99

Name RAM MANOHAR
Title MANAGER, SPECTRUM
Address Inmarsat Ltd.; 99, City Road, LondonEC1Y 1AX
Telephone +44-171-728-1512.

CERTIFICATE OF SERVICE

I, Robert L. Galbreath, hereby certify that copies of the attached Comments of Inmarsat Ltd., were served on June 21, 1999, via hand delivery, on the following parties:

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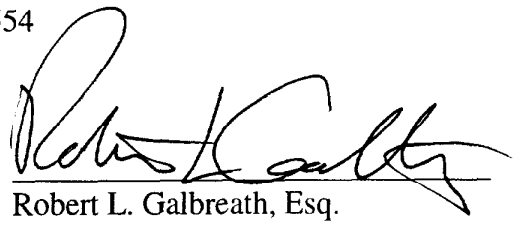

Robert L. Galbreath, Esq.